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Case Docket No. PHN 17,489

THE COMMISSIONER OF PATENTS AND TRADEMARKS, Washington, D.C. 20231

Enclosed for filing is the patent application of Inventor:  
JOSEPHUS M.M. VAN GASTEL

**FOR: COMPONENT PLACEMENT MACHINE****ENCLOSED ARE:**

- ☒ Appointment of Associates;  
☒ Information Disclosure Statement, Form PTO-1449 and copies of documents listed therein;  
☒ Preliminary Amendment;  
☒ Specification (8 Pages of Specification, Claims, & Abstract);  
☒ Declaration and Power of Attorney:  
 (1 Page of a ☐ fully executed ☒ unsigned Declaration);  
☒ Drawing (1 sheet of ☐ informal ☒ formal sheet);  
☒ Certified copy of European Application Serial #99201924.0  
☒ Authorization Pursuant to 37 CFR §1.136(a)(3)  
☐ Other: ;  
☐ Assignment to

**FEE COMPUTATION**

CLAIMS AS FILED				
FOR	NUMBER FILED	NUMBER EXTRA	RATE	BASIC FEE - \$690.00
Total Claims	4 - 20 =		X \$18 =	0.00
Independent Claims	1 - 3 =		X \$78 =	0.00
Multiple Dependent Claims, if any			\$260 =	0.00
TOTAL FILING FEE . . . . .				= \$690.00

Please charge Deposit Account No. 14-1270 in the amount of the total filing fee indicated above, plus any deficiencies. The Commissioner is also hereby authorized to charge any other fees which may be required, except the issue fee, or credit any overpayment to Account No. 14-1270.

☐ Amend the specification by inserting before the first line as a centered heading --Cross Reference to Related Applications--; and insert below that as a new paragraph --This is a continuation-in-part of application Serial No. , filed , which is herein incorporated by reference--.

**CERTIFICATE OF EXPRESS MAILING**

Express Mail Mailing Label No. EL 335 549 958 US

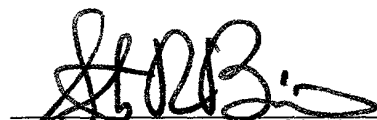
Date of Deposit: June 15, 2000

I hereby certify that this paper and/or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Patti DeMichele

Typed Name

Signature



Steven R. Biren, Reg.No. 26,531

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Atty. Docket

JOSEPHUS M.M. VAN GASTEL

PHN 17,489

Serial No.

Filed: CONCURRENTLY

COMPONENT PLACEMENT MACHINE

Honorable Commissioner of Patents and Trademarks  
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to calculation of the filing fee and examination,  
please amend the above-identified application as follows:

IN THE TITLE

Please change the Title to all Capital Letters and delete "."  
(period).

IN THE SPECIFICATION

Page 1, before line 1, insert as a centered heading:

--BACKGROUND OF THE INVENTION--;

Page 2, between lines 9 and 10, insert as a centered heading:

--SUMMARY OF THE INVENTION--;

Page 4, between lines 3 and 4, insert as a centered heading:

--BRIEF DESCRIPTION OF THE DRAWING--;

between lines 5 and 6, insert as a centered heading:

--DESCRIPTION OF THE PREFERRED EMBODIMENTS--;

IN THE CLAIMS

Page 6, before line 1, replace "CLAIMS:" with

--WHAT IS CLAIMED IS:--

IN THE ABSTRACT

Before line 1, delete "ABSTRACT:" and substitute the following as a centered heading:

--ABSTRACT OF THE DISCLOSURE--;

last line, delete "Figure".

REMARKS

The Abstract and Specification have been amended to add headings in accordance with MPEP Section 601 and place the instant application in standard U.S. format.

Entry of this amendment prior to calculating the filing fee is respectfully requested.

Respectfully submitted,

By   
Steven R. Biren, Reg. 26,531  
Attorney  
(914) 333-9630  
June 13, 2000

## Component placement machine.

The invention relates to a component placement machine for placing components on a printed circuit board, comprising:

- a transport device for transporting printed circuit boards in an X-direction,
- on either side of the transport device, respectively, a first and a second feeder area, in each  
5 of which there is at least one feeder with components,
- a Y-slide, which is drivable in the X-direction, and
- a placement head on said Y-slide, which placement head is drivable in a Y-direction.

Such a machine is known from WO-A-9738567. This machine can be very flexibly used for different types of printed circuit boards. The placement head can reach all  
10 positions of the feeder area and of the area above a printed circuit board. The transport of printed circuit boards is relatively simple. The printed circuit boards only have to be clamped at the edges (in the X-direction). By means of a camera, the exact position of the printed circuit board can be determined. A drawback of this machine is, however, that the output, i.e. the number of components which can be placed per unit of time, is limited.

15 Placement machines by means of which very many components (60,000-90,000 comp/h) can be placed on printed circuit boards are known. Such machines have a large number of fixed Y-slides, each slide having a placement head which can be moved in the Y-direction with a large stroke and in the X-direction with a small stroke. These machines have a so-called indexed transport system for the printed circuit boards, i.e. the printed circuit boards  
20 are always transported over a fixed distance in the X-direction. Such a transport system includes a slide on which there are a number of positioning pins which are inserted into holes of the printed circuit boards, whereafter said positioning pins advance the printed circuit boards simultaneously over a predetermined distance in the X-direction, after which the printed circuit boards are supported at the side edges, and subsequently the pins are withdrawn  
25 from the holes and the slide returns to its starting position. In one placement period, generally components can be placed only on a part of the printed circuit board. After the printed circuit boards have been advanced in an indexed manner, components can be placed on a next part of the printed circuit board in the subsequent placement period. The fixed Y-slide, the limited stroke of the placement head in the X-direction and the indexed transport system for the

printed circuit boards contribute substantially to achieving a high output. A drawback of such machines resides in the limited flexibility, i.e. when other types of printed circuit boards have to be provided with components, a number of machine parts have to be moved or replaced, whereafter the new setting has to be re-calibrated. These changes relate particularly to the parts necessary for supporting and transporting the printed circuit boards. It takes approximately 2 to 4 hours to carry out such changes. During this period of time, the machine is idle. Another drawback resides in that such machines are sensitive to cluster formation. That is to say, if the components are not uniformly distributed over the printed circuit board, but instead are located so as to form concentrations (clusters), the output is adversely affected.

It is an object of the invention to provide a component placement machine having a large output, i.e. the number of components which can be placed per unit of time is relatively large, while the machine still exhibits a great flexibility.

A further object of the invention is to provide a method of placing components on printed circuit boards by means of a component placement machine in accordance with the invention.

To achieve this, the component placement machine in accordance with the invention is characterized in that the Y-slide is provided with at least two placement heads which can be independently driven in a Y-direction.

Such a machine concept makes it possible to pick up a component from one of the feeders with one of the placement heads while, simultaneously, one of the other placement heads is used to make preparations for the placement of a component on the printed circuit board. Conversely, such a machine concept also makes it possible to place a component onto a printed circuit board by means of one of the placement heads while, simultaneously, preparations are made with one of the other placement heads to pick up a component from one of the feeders. It will be clear that, as a result thereof, the output of the machine is considerably increased. The machine also has a great flexibility because each placement head can reach every part of at least a number of feeders and every part of the printed circuit board. Many different printed circuit boards, particularly as regards the dimensions, can be used because a relatively simple transport system for the printed circuit boards is sufficient. Consequently, for example, an indexed printed circuit board transport can be dispensed with.

A further increase of the output can be obtained when the machine is provided with a number of Y-slides, which are independently drivable in the X-direction, each Y-slide being provided with at least two placement heads. By virtue thereof, a number of placement heads can pick up components simultaneously from at least one feeder or place components simultaneously on a printed circuit board in the desired X-Y position.

A method of placing components on a printed circuit board using an above-described component-placement machine is characterized in that

- in a first period of time, a first placement head moves to a desired X-Y position above a first feeder and, subsequently, picks up a component from the first feeder, a second  
5 placement head moves along the Y-slide to a desired Y-position so as to prepare for the placement of a previously picked-up component on the printed circuit board,
- in a second period of time following the first period of time, the second placement head moves to a desired X-Y position above the printed circuit board and subsequently places the component on the printed circuit board,
- 10 - in a third period of time following the second period of time, the second placement head moves to a desired X-Y position above a second feeder and, subsequently, picks up a component from the second feeder, the first placement head moves along the Y-slide to a desired Y-position so as to prepare for the placement onto the printed circuit board of the component picked up in the first period of time, and
- 15 - in a fourth period of time following the third period of time, the first placement head moves to a desired X-Y position above the printed circuit board and, subsequently, places the component on the printed circuit board.

If the placement machine is provided with a number of Y-slides, which are independently drivable in the X-direction, each Y-slide being provided with at least two  
20 placement heads, the method is characterized in that

- in a first period of time, a first series of placement heads moves to a desired X-Y position above a first feeder and, subsequently, simultaneously picks up components from the first feeder, a second series of placement heads moves along the Y-slide to a desired Y-position so as to prepare for the placement on the printed circuit board of previously picked-up  
25 components,
- in a second period of time following the first period of time, the second series of placement heads moves to a desired X-Y position above the printed circuit board and, subsequently, places the components simultaneously on the printed circuit board,
- in a third period of time following the second period of time, the second series of  
30 placement heads moves to a desired X-Y position above a second feeder and, subsequently, simultaneously picks up components from the second feeder, the first series of placement heads moves along the Y-slide to a desired Y-position so as to prepare for the placement on the printed circuit board of the components picked up in the first period of time, and

- in a fourth period of time following the third period of time, the first series of placement heads moves to a desired X-Y position above the printed circuit board and, subsequently, places the components simultaneously on the printed circuit board.

These and other aspects of the invention will be elucidated by means of a single drawing which is a diagrammatic plan view of a component placement machine.

The transport device 1 is represented by two transport bars 2 over which printed circuit boards 3 are transported. The transport mechanism used for this purpose is not shown. A clamping mechanism used to clamp the printed circuit boards at the edges is not shown either. On either side of the transport device there is, respectively, a first and a second feeder area 4, 5. Each feeder area comprises a number of feeders, for example 6<sub>a</sub>, 6<sub>b</sub>, 6<sub>c</sub>, 6<sub>d</sub> and 7<sub>a</sub>, 7<sub>b</sub>, 7<sub>c</sub>, 7<sub>d</sub>, respectively, with components. Above the printed circuit boards and the feeders there are Y-slides which are independently drivable in the X-direction. In this example, there are four Y-slides 8-11. On each Y-slide there are two placement heads H<sub>xx</sub>. On the slide 8 there are the placement heads H<sub>11</sub> and H<sub>12</sub>, on the slide 9 there are the heads H<sub>21</sub> and H<sub>22</sub>, on the slide 10 there are the heads H<sub>31</sub> and H<sub>32</sub>, and on the slide 11 there are the heads H<sub>41</sub> and H<sub>42</sub>.

The placement of components 12 on a printed circuit board 3 takes place as follows:

It is assumed that the placement heads H<sub>12</sub>, H<sub>22</sub>, H<sub>32</sub> and H<sub>42</sub> already have picked up components 12 from the feeders 7<sub>a</sub>, 7<sub>b</sub>, 7<sub>c</sub>, 7<sub>d</sub>.

In a first period of time, the placement heads H<sub>11</sub>, H<sub>21</sub>, H<sub>31</sub> and H<sub>41</sub> each move to a desired X-Y position above one of the feeders 6<sub>a</sub>, 6<sub>b</sub>, 6<sub>c</sub>, 6<sub>d</sub> and, subsequently, simultaneously pick up a component 12 from the feeder. In this period of time, the placement heads H<sub>12</sub>, H<sub>22</sub>, H<sub>32</sub> and H<sub>42</sub>, which have already picked up components, also move to a desired Y-position above the printed circuit board 3. These Y-positions correspond to the Y-position of the place where the component in question must be placed on the printed circuit board.

In the second period of time, the placement heads H<sub>12</sub>, H<sub>22</sub>, H<sub>32</sub> and H<sub>42</sub> move on to the desired X-position above the printed circuit board, so that the placement heads are each situated exactly above the X-Y position where the components must be placed on the printed circuit board. Subsequently, the components in question are simultaneously placed on the printed circuit board.

In the third period of time, the placement heads H<sub>12</sub>, H<sub>22</sub>, H<sub>32</sub> and H<sub>42</sub> each move to a desired X-Y position above one of the feeders 7<sub>a</sub>, 7<sub>b</sub>, 7<sub>c</sub>, 7<sub>d</sub> and subsequently simultaneously pick up a component 12 from the feeder. In this third period of time, the placement heads H<sub>11</sub>, H<sub>21</sub>, H<sub>31</sub> and H<sub>41</sub> also move, with the components picked up in the first

period of time, to a desired Y-position above the printed circuit board 3. These Y-positions correspond to the Y-position of the place where the component in question must be placed on the printed circuit board.

5 In the fourth period of time, the placement heads  $H_{11}$ ,  $H_{21}$ ,  $H_{31}$  and  $H_{41}$  move on to the desired X-position above the printed circuit board, so that the placement heads are each situated exactly above the X-Y position where the components must be placed on the printed circuit board. Subsequently, the components in question are simultaneously placed on the printed circuit board.

Subsequently, the procedure of the first period of time is repeated, etc.

10 The placement machine can be easily extended, for example, by providing more Y-slides, in particular by applying a modular build-up. In addition, it is possible to apply a plurality of pick-up elements per placement head. Pick-up elements are, for example, suction pipettes by means of which components are picked up and placed.



## CLAIMS:

1. A component placement machine for placing components on a printed circuit board, comprising:

- a transport device for transporting printed circuit boards in an X-direction,
  - on either side of the transport device, respectively, a first and a second feeder area, in each
  - 5 of which there is at least one feeder with components,
  - a Y-slide, which is drivable in the X-direction, and
  - a placement head on said Y-slide, which placement head is drivable in a Y-direction,
- characterized in that the Y-slide is provided with at least two placement heads which can be independently driven in a Y-direction.

2. A component placement machine as claimed in claim 1, characterized in that a number of Y-slides are present, which are independently drivable in the X-direction, each Y-slide being provided with at least two placement heads.

15 3. A method of placing components on a printed circuit board by means of a component placement machine as claimed in claim 1, characterized in that

- in a first period of time, a first placement head moves to a desired X-Y position above a first feeder and, subsequently, picks up a component from the first feeder, a second placement head moves along the Y-slide to a desired Y-position so as to prepare for the
- 20 placement of a previously picked-up component on the printed circuit board,
- in a second period of time following the first period of time, the second placement head moves to a desired X-Y position above the printed circuit board and, subsequently, places the component on the printed circuit board,
- in a third period of time following the second period of time, the second placement head
- 25 moves to a desired X-Y position above a second feeder and, subsequently, picks up a component from the second feeder, the first placement head moves along the Y-slide to a desired Y-position so as to prepare for the placement on the printed circuit board of the component picked up in the first period of time, and

- in a fourth period of time following the third period of time, the first placement head moves to a desired X-Y position above the printed circuit board and, subsequently, places the component on the printed circuit board.

5 4. A method of placing components on a printed circuit board by means of a component placement machine as claimed in claim 2, characterized in that

- in a first period of time, a first series of placement heads moves to a desired X-Y position above a first feeder and, subsequently, simultaneously picks up components from the first feeder, a second series of placement heads moves along the Y-slide to a desired Y-position so as to prepare for the placement on the printed circuit board of previously picked-up components,

- in a second period of time following the first period of time, the second series of placement heads moves to a desired X-Y position above the printed circuit board and, subsequently, places the components simultaneously on the printed circuit board,

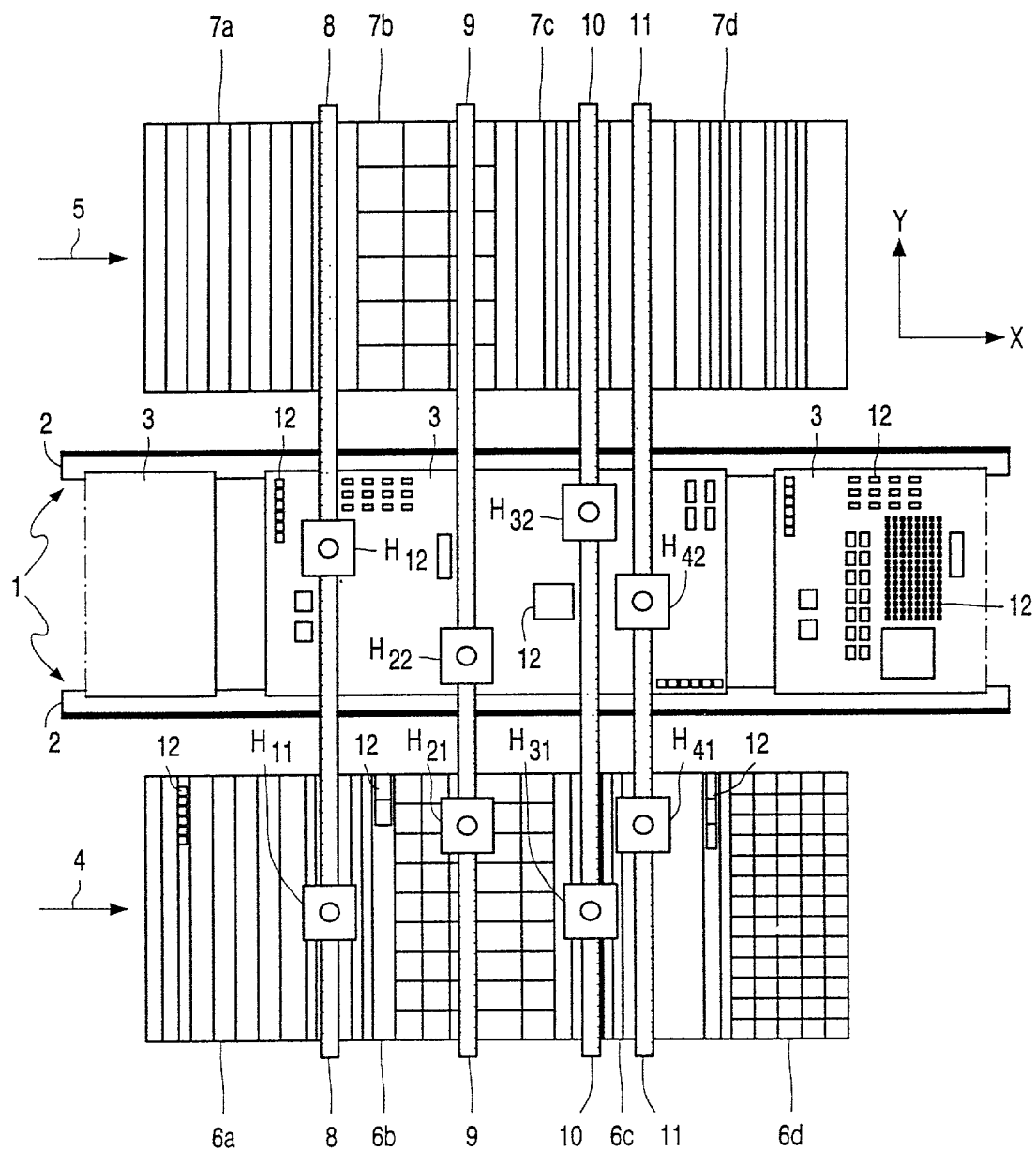
- 15 - in a third period of time following the second period of time, the second series of placement heads moves to a desired X-Y position above a second feeder and, subsequently, simultaneously picks up components from the second feeder, the first series of placement heads moves along the Y-slide to a desired Y-position so as to prepare for the placement on the printed circuit board of the components picked up in the first period of time, and

- 20 - in a fourth period of time following the third period of time, the first series of placement heads moves to a desired X-Y position above the printed circuit board and, subsequently, places the components simultaneously on the printed circuit board.

## ABSTRACT:

A component placement machine comprising a transport device (1) for transporting PCBs (3) in an X-direction, a first and a second feeder area (4, 5), each area comprising at least one feeder (6<sub>a</sub>, 6<sub>b</sub>, 6<sub>c</sub>, 6<sub>d</sub>, 7<sub>a</sub>, 7<sub>b</sub>, 7<sub>c</sub>, 7<sub>d</sub>) for storing components, at least one Y-slide beam (8-11) which is drivable in the X-direction, and at least two placement heads (H<sub>xx</sub>) on each Y-slide beam, which placement heads are drivable in the Y-direction. Such a machine enables a number of actions to be performed simultaneously. For example, within a certain period of time, a plurality of placement heads can simultaneously pick up components from a feeder, while in the same period of time, other placement heads, having picked up components at an earlier stage, are moved to desired X-positions of the PCB. This results in an improved output.

Figure



# DECLARATION and POWER OF ATTORNEY

ATTORNEY'S DOCKET NO.:

PHN 17.489

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**"Component placement machine"**

the specification of which (check one)

☐ is attached hereto.

☐ was filed on \_\_\_\_\_ as Application Serial No. \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by the amendment(s) referred to above.

I acknowledge the duty to disclose information which is material to patentability of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

COUNTRY	APP. NUMBER	DATE OF FILING (DATE, MONTH, YEAR)	PRIORITY CLAIMED UNDER 35 U.S.C. 119
Europe	99201924.0	16 June 1999	YES

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35 United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

PRIOR UNITED STATES APPLICATION(S)

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (PATENTED, PENDING, ABANDONED)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Algy Tamoshunas, Reg. No. 27,677

Jack E. Haken, Reg. No. 26,902

SEND CORRESPONDENCE TO: Corporate Patent Counsel; U.S. Philips Corporation; 580 white Plains Road; Tarrytown, NY 10591	DIRECT TELEPHONE CALLS TO: (name and telephone No.) (914) 332-0222
--	--

Dated:		Inventor's Signature:		
Full Name of in Inventor	Last Name <b>VAN GASTEL</b>	First Name <b>Josephus</b>	Middle Name <b>Martinus Maria</b>	
Residence & Citizenship	City <b>Eindhoven</b>	State of Foreign Country <b>The Netherlands</b>	Country of Citizenship <b>The Netherlands</b>	
Post Office Address	Street <b>Prof. Holstlaan 6</b>	City <b>5656 AA Eindhoven</b>	State of Country <b>The Netherlands</b>	Zip Code

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JOSEPHUS M.M. VAN GASTEL

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COMPONENT PLACEMENT MACHINE

Honorable Commissioner of Patents and Trademarks  
Washington, D.C. 20231

APPOINTMENT OF ASSOCIATES

Sir:

The undersigned Attorney of Record hereby revokes all prior appointments (if any) of Associate Attorney(s) or Agent(s) in the above-captioned case and appoints:

Steven R. Biren (Registration No. 26,531)  
c/o U.S. PHILIPS CORPORATION, Intellectual Property Department, 580 White Plains Road, Tarrytown, New York 10591, his Associate Attorney(s)/Agent(s) with all the usual powers to prosecute the above-identified application and any division or continuation thereof, to make alterations and amendments therein, and to transact all business in the Patent and Trademark Office connected therewith.

ALL CORRESPONDENCE CONCERNING THIS APPLICATION AND THE LETTERS PATENT WHEN GRANTED SHOULD BE ADDRESSED TO THE UNDERSIGNED ATTORNEY OF RECORD.

Respectfully,

  
Jack E. Haken, Reg. 26,902  
Attorney of Record

Dated at Tarrytown, New York  
this 14TH day of June 2000.